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RT OF THE OFFICE OF COAL DEVELOPMENT AND MARKETING

1989 ◆ 1990

DEPOSITORY
AUG 28 1991
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

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Illinois Department of
Energy and Natural Resources

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REPORT OF
THE OFFICE OF
COAL DEVELOPMENT AND MARKETING

1989 ◆ 1990

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To the residents of Illinois:

It is my pleasure to join with Director Witter in presenting to you the 1989-1990 Annual Report of the Illinois Coal Development Board and the Office of Coal Development and Marketing. Early in my term as Governor of Illinois, the General Assembly and I agreed on the need to assemble a board of representatives of state govenment and coal-related industries capable of providing comprehensive and integrated expertise to oversee and guide the direction of Illinois' vast coal research efforts.

The Board has approached its tasks with persistence and enthusiasm, and the General Assembly and I can be proud of both the significant achievements already made and the groundwork that has been established for the future. The energy and economic benefits which Illinois can realize from a strong and effective Coal Development Board and Office of Coal Development and Marketing are clearly a powerful incentive for continued support of this program.

I am confident that, as you leaf through this report, you will agree that the Coal Development Board plays a vital role in maintaining and improving economic development and the quality of life in Illinois.

James R. Thompson
Governor

Coal's Impact on the Illinois Economy

Forty mines provide over 12,500 jobs and 25,000 spinoff jobs.

Each year, $1.5 billion is contributed to the state's economy by coal mining.

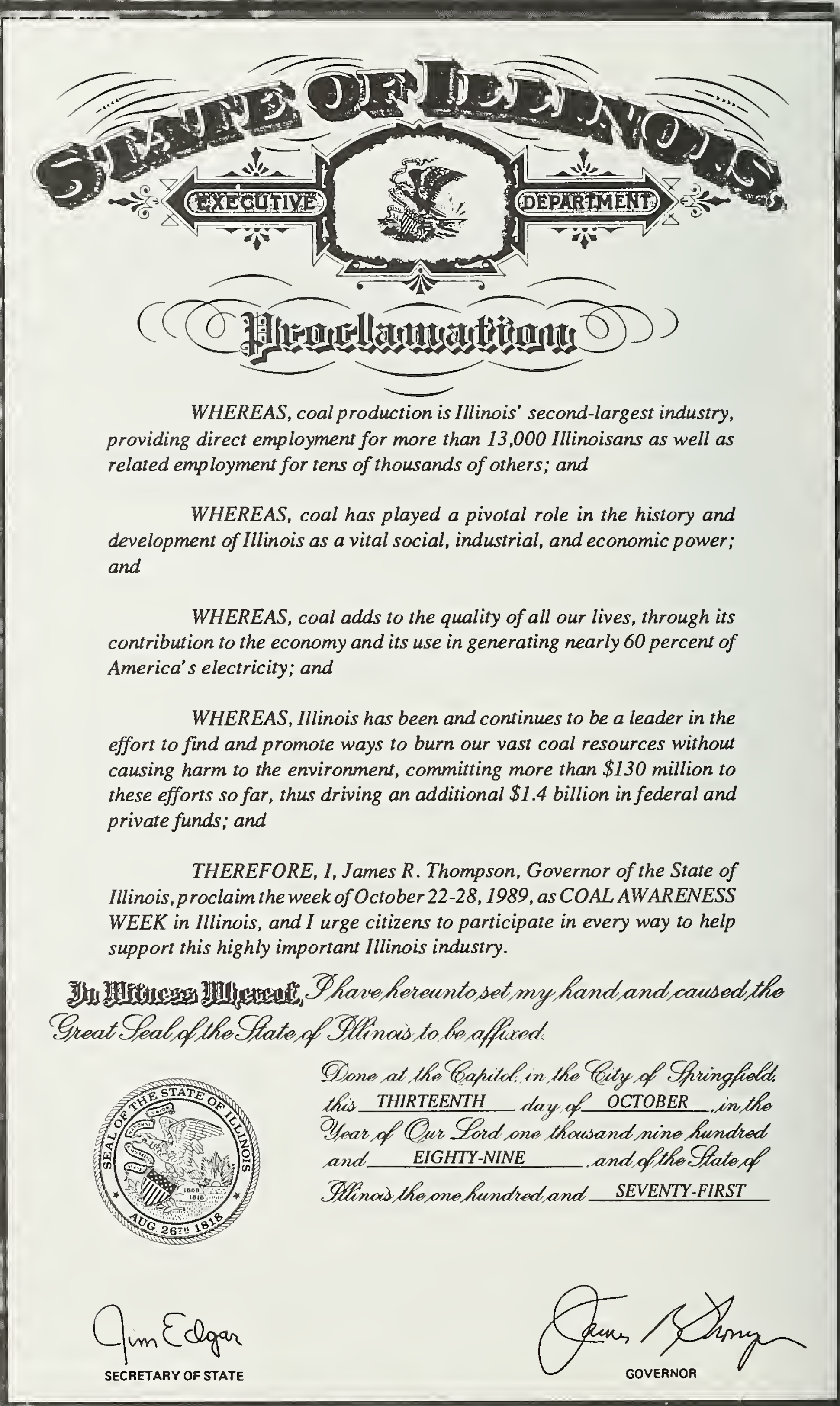
Total payroll: $500 million a year

Throughout the history of Illinois, coal has played a key role in shaping the people and the economy of the state. This report, prepared by the Illinois Department of Energy and Natural Resources, Office of Coal Development and Marketing, describes just how important this vital natural resource is to Illinois.

This report also focuses on an issue that's important to everyone—the protection of our environment. Illinois, its coal producers and the federal government are working hard to find new ways to burn Illinois coal more cleanly. Great strides have been made to discover and demonstrate clean coal technologies to burn coal far more cleanly today than just a few years ago.

Continued cooperation between the public and private sectors to develop clean coal technologies is necessary to make coal an efficient and economical source of energy for the 21st century.

Karen A. Witter, Director
Illinois Department of Energy
and Natural Resources



STATE OF ILLINOIS

EXECUTIVE DEPARTMENT

Proclamation

WHEREAS, coal production is Illinois' second-largest industry, providing direct employment for more than 13,000 Illinoisans as well as related employment for tens of thousands of others; and

WHEREAS, coal has played a pivotal role in the history and development of Illinois as a vital social, industrial, and economic power; and

WHEREAS, coal adds to the quality of all our lives, through its contribution to the economy and its use in generating nearly 60 percent of America's electricity; and

WHEREAS, Illinois has been and continues to be a leader in the effort to find and promote ways to burn our vast coal resources without causing harm to the environment, committing more than $130 million to these efforts so far, thus driving an additional $1.4 billion in federal and private funds; and

THEREFORE, I, James R. Thompson, Governor of the State of Illinois, proclaim the week of October 22-28, 1989, as COAL AWARENESS WEEK in Illinois, and I urge citizens to participate in every way to help support this highly important Illinois industry.

In Witness Whereof, I have hereunto set my hand and caused the Great Seal of the State of Illinois to be affixed.

Done at the Capitol, in the City of Springfield, this THIRTEENTH *day of* OCTOBER *, in the Year of Our Lord one thousand nine hundred and* EIGHTY-NINE *, and of the State of Illinois the one hundred and* SEVENTY-FIRST

AUG 26TH 1818

Jim Edgar
SECRETARY OF STATE

James R Thompson
GOVERNOR

INTRODUCTION

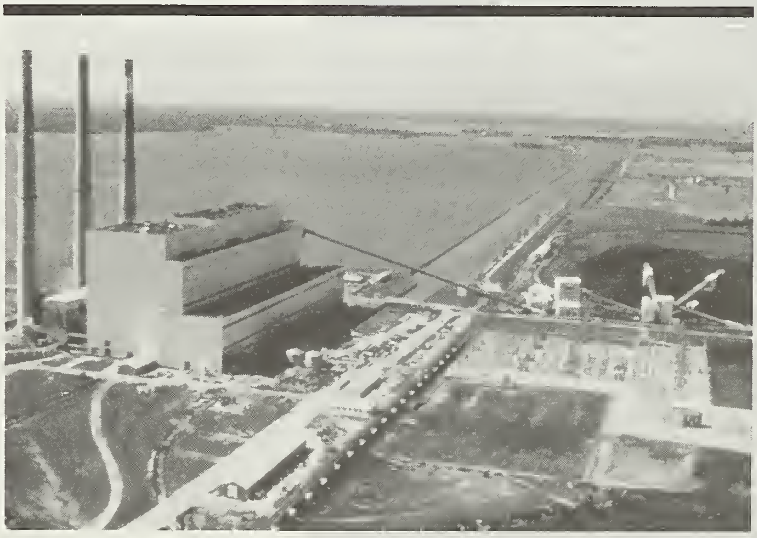
The Office of Coal Development and Marketing

Because Illinois' most abundant and economically important resource is high sulfur coal, the Illinois Department of Energy and Natural Resources (ENR) carries a tremendous responsibility to develop and manage this energy resource for Illinois' future. Illinois' coal development programs have received national recognition for research on commercialization of clean coal technologies.

The ENR Office of Coal Development and Marketing addresses the varied problems that plague Illinois coal production by maintaining a strong commitment to innovative technology development. The future of Illinois coal depends on the new technologies in mining, preparation, combustion, and environmental controls toward which ENR-sponsored projects are working.

In addition to the efforts being conducted in public and private laboratories throughout Illinois, the state's coal office sponsors large-scale demonstration projects through the Clean Coal Technology Demonstration Program. The goal of this $113 million program is to bring promising technologies to full commercialization. This level of funding supported by Governor James R. Thompson and the General Assembly has been a key factor in the development of a successful Illinois coal research and demonstration program.

The Office has determined that a gap exists between the extensive laboratory research being conducted on coal at Illinois universities and institutions and the large-scale demonstration being done by the state in conjunction with private industry and the federal government. ENR and the Illinois Coal Development Board have taken the initial step to bridge that gap by creating a pilot-scale development program to complement programs already in place. Total costs for each development-scale project are expected to be between $500,000 and $2 million. Through the Coal Technology Development Assistance Fund, the state plans to co-fund such projects with institutional and industrial research facilities.



Illinois Coal Development Board Members

(Statutory Appointments)
Chair:
Karen A. Witter, Director
Illinois Department of Energy and Natural Resources
Steve McClure, Director
Illinois Department of Commerce and Community Affairs
Designee:
Tom Wimberly
Illinois Department of Commerce and Community Affairs
Marion, IL
Richard Shockley, Director
Illinois Department of Mines and Minerals

(Co-chairpersons of the Citizens Council on Energy Resources)
Senator Ralph Dunn
DuQuoin, IL
Representative David Phelps
Eldorado, IL

Illinois Coal Development Board Members

(Public Members)

Wilbur W. Dodge
Private Consultant
Peoria, IL

Mrs. Linda A.F. Dutcher
Professional Geologist
Carbondale, IL

Edgar Hale
United Mine Workers of America
Pinckneyville, IL

Richard E. Newtson
A.G. Edwards and Sons
Springfield, IL

David L. Stritzel
Zeigler Coal Company
Carterville, IL

Porter Womeldorff, V.P.
Illinois Power
Decatur, IL

(Past Members)

Designee:

Dean Bair
Illinois Department of Commerce and Community Affairs

Hon. James F. Rea
State Representative
Christopher, IL

Theodore A. Bean
Vice President - Marketing and Transportation
Freeman United Coal Mining Company

The high sulfur content of the state's bituminous coal resources is a recognized factor preventing the Illinois coal industry from achieving its full potential. Much of the nearly $20 million in state funds devoted to laboratory research since 1981 has been directed toward solving the sulfur problem of Illinois coal. Advances in exploratory and applied research are critical to increased usage.

The Office also administers the Illinois Coordinated Review Process, which offers informational assistance regarding the issuing of permits for major energy development projects, and the Illinois Coal Marketing Program, which promotes clean coal technologies and use of Illinois coal in domestic and international markets.

The Illinois Coal Development Board

Since the Illinois Coal Development Board's creation by Governor James R. Thompson and the General Assembly in 1981, it has played a pivotal role in advancing new technologies that enhance the use of Illinois coal. Empowered by the same legislative mandates that govern the Illinois Department of Energy and Natural Resources, the board annually establishes research priorities. Other functions include coordinating and funding coal research programs to complement the existing Illinois coal demonstration efforts. Since December 1985, the board has exercised final approval authority over all research, demonstration, and industrial coal utilization projects recommended by the ENR coal office.

By state statute, the Illinois Coal Development Board is composed of 11 voting members representing government and industry. The collective experience of these board members provides for expert administration of Illinois' coal research efforts. The state government members are the director of the Illinois Department of Energy and Natural Resources, who serves as chair; the director of the Illinois Department of Mines and Minerals; the co-chairs of the General Assembly's Citizens Council on Energy Resources; and the director of the Illinois Department of Commerce and Community Affairs. Appointed by the governor and confirmed by the Illinois Senate, the public members of the board represent industries involved in extraction, use, or transportation of Illinois coal and persons representing financial or banking interests in the state.

COAL TECHNOLOGY DEVELOPMENT: RESEARCH AND DEMONSTRATION

The Illinois Coal Research Program

The coal industry is facing a crucial period in its centuries-old history. Stringent acid rain control legislation could result in severe market losses for Illinois coal. The future of Illinois' coal industry will be greatly affected by the outcome of legislative proposals on the federal level and by the success of new technologies being developed through the Illinois Coal Research Program.

Initiated in 1981, the state's coal research program sponsors the advancement of clean and environmentally safe ways to burn coal. In the past eight years, more than $20 million in state funds has been spent on laboratory-scale research unraveling the sulfur problem that has limited the usage of Illinois coal in the past. Some technologies have already reached commercial application or are now being tested on the large demonstration scale. However, major breakthroughs regarding cleaning and using high sulfur coal in a way that will assure major growth in the Illinois coal industry still remain the responsibility of research laboratories. The exploratory and applied research programs sponsored by the Illinois Coal Development Board are dedicated to increasing the use of Illinois coal through development of environmentally safe cleaning and combustion methods.

Sulfur-In-Coal Research

Since 1982, the board has directed its research efforts toward the challenge of determining an economically feasible solution to the problem of sulfur in Illinois coal. During 1989-1990, $4 million in research funds was designated for investigation into practical methods of removing the sulfur.

The Illinois Coal Development Board through ENR oversees the Center for Research on Sulfur in Coal (CRSC). Formerly located in Champaign, Illinois, the Center moved to the heart of coal country in April 1989 to be housed at the Illinois Coal Development Park, Carterville, Illinois, along with several other coal-related agencies. The nationally known CRSC administers a state-sponsored research program at various Illinois institutions. Quarterly and annual reports on research results are available from the CRSC.

Researchers representing both the public and private sectors are encouraged to collaborate and use the many capabilities offered at the Illinois Coal Development Park. Successful results will require such collaborative efforts among the wide-ranging disciplines and expertise found in scientific institutions, universities and industry. Researchers from the Illinois State Geological Survey, Eastern Illinois University, Northwestern University, and Southern Illinois University at Carbondale are among several who have already formed collaborative arrangements.

The program also continues the cost-sharing initiative begun in 1986 with such organizations as the U.S. Department of Energy, the Electric Power Research Institute, and the Gas Research Institute. These shared-cost projects broaden the resource and information bases for studies of Illinois coal.

Through access to common coal specimens, the CRSC's coal sample bank, located at the Illinois State Geological Survey applied research laboratory, further augments the resources available to researchers by reducing the associated costs and extending the range of experimentation. In addition to the five representative Illinois coal samples, users of the coal sample bank now have the opportunity to perform comparative studies on an Indiana coal specimen, through the cooperation of the Indiana Energy Development Board and the Indiana Geological Survey.

Mine Subsidence Research

An issue of great concern for both farmers and mine operators is how to mitigate the effects of subsidence produced by high-extraction mining because most coal reserves underlie prime farmland. The Illinois Mine Subsidence Research Program (IMSRP) is a successful cost-sharing effort that began in 1985 with an agreement between the Illinois Department of Energy and Natural Resources, funded by the Illinois Coal Development Board, and the U.S. Bureau of Mines to address such issues. It is one of few such programs in the United States and, as such, has received national attention. Surface subsidence related to underground mining has presented extensive land-use problems for the agriculture and mining industries of Illinois. This program of research focuses on finding underground mining methods that will benefit both industries by extracting maximum amounts of coal while simultaneously safeguarding land resources.

The public information efforts of the program were expanded in 1988 to increase awareness of the long-standing problem and the need for the program. Data from all areas of research are included in an extensive IMSRP database management program. A relational database management system is being used to compile comprehensive files on rock mechanics, locations, agronomy data, well logs, and other research information. Several publications and informational exhibits acquainted industrial, public, and scientific audiences with program objectives.

The Illinois State Geological Survey oversees the program's research at the Survey, the University of Illinois, Southern Illinois University at Carbondale, and Northern Illinois University.

THE ILLINOIS CLEAN COAL TECHNOLOGY DEMONSTRATION PROGRAM

Promising technological advances developed for coal in the research laboratories can progress toward commercialization through the coal demonstration program. Potential demonstration projects must exhibit qualities of eminent commercial readiness, economic feasibility, significant innovation, and environmental acceptability before reaching this level. To date, more than $95.5 million in state monies have been committed from the Coal Development Fund for 16 large-scale demonstration projects to demonstrate the applicability of innovative clean coal technologies.

This investment of state funds will result in additional investments of almost $688.9 million from other public or private sources. The Illinois Clean Coal Technology Demonstration Program exemplifies a successful partnership between the public and private sectors, in which the burden of technical and financial risk is shared between them.

The University of Illinois' Abbott Power Plant, the largest state-owned power plant and the nation's largest university power plant, stopped using coal in 1972 when it was decided that conversion to oil and gas made more economic sense than did the installation of equipment that now would bring the facility into compliance with environmental emission standards.

As a direct result of the Governor's 1980 Task Force on Energy Conservation and Coal Conversion, it was announced in 1982 that a decision had been made to install an innovative scrubber technology at the University's Abbott Power Plant which would meet all new source emission and ambient air quality standards for the project site, and would permit the facility to return to burning coal for campus heating and cooling. Representatives from the Illinois Capital Development Board, the Illinois Department of Energy and Natural Resources and the University provided the project management.

Unlike other Coal Development Fund projects, the reconversion of three oil-and natural gas-fired boilers to coal, and installation of an innovative flue gas cleanup system at the University's power plant has been entirely state-funded. The Electric Power Research Institute participated by funding the evaluation and testing of the innovative CT-121 system.

The Chiyoda Thoroughbred (CT-121) was selected by the management team to be demonstrated. This scrubber process is a second generation flue gas desulfurization system that uses limestone, rather than lime, to chemically remove the sulfur dioxide (SO_2) from the flue gases that result from the combustion of coal. Because the CT-121 is designed to be highly efficient without the additional components required by conventional limestone scrubbers, the system is more reliable and cost efficient.

The main components of the CT-121 are the prescrubber, the Jet Bubbling Reactor (JBR), and the mist eliminator. The JBR is a single vessel that serves as both the absorption vessel and reactor tank. It therefore requires far less space then the conventional scrubber.

Reconversion and scrubber installation costs were estimated at $21.9 million, with $4.95 million coming from the Coal Development Fund. The Capital Development Fund provided the balance of funding.

The CT-121 has been operating since April 1988, consistently removing 95 percent of the sulfur dioxide and producing a waste product of high quality gypsum. The gypsum is undergoing tests by several manufacturers for inclusion in their products. The new system uses about 100,000 tons of high sulfur Illinois coal and 9,000 tons of limestone annually. It is projected that the use of coal for heating, cooling, and electricity generation will save the university at least $5 million annually.

The economic welfare of Illinois is deeply dependent on the status of the state's considerable industrial base. Reducing industry operating expenses by lowering fuel costs through the use of improved coal use technologies offers benefits for everyone.

The following is a list of projects receiving financial support through the Illinois Clean Coal Technology Demonstration Program. Also provided is Total Estimated Project Cost and State Contribution.

PROJECT	TOTAL COST	*STATE (ESTIMATED) COMMITMENT*
1. Combustion Engineering Atmospheric Fluidized Bed Combustion Demonstration	$20,218,569	*$750,000*
2. Allis-Chalmers/KILnGAS Coal Gasification-Combined Cycle Demonstration	$219,900,000	*$26,223,100*
3. B.F. Goodrich Circulating Fluidized Bed Combustion Demonstration	$12,300,000	*$4,300,000*
4. Midwest Grain Products Fluidized Bed Combustion-Cogeneration Demonstration	$19,300,000	*$2,500,000*
5. Archer Daniels Midland Circulating Fluidized Bed Combustion-Cogeneration Demonstration	$100,000,000	*$6,000,000*

6. University of Illinois Abbott Power Plant Reconversion - Scrubber Demonstration	$21,900,000	*$4,950,000*
7. Anderson Clayton Foods Wormser Duel Fluidized Bed Combustion Demonstration	$5,200,000	*$1,000,000*
8. UOP, Inc. Copper-Oxide Flue Gas Desulfurization Proof of Concept Demonstration	$13,500,000	*$1,000,000*
9. EERC, Gas Reburning - Sorbent Injection Demonstration	$30,000,000	*$5,000,000*
10. (2 Sites) Radian Corp./CIPS Duct Injection Demonstration	$4,310,000	*$600,000*
11. TransAlta Low NO_x/SO_2 Burner Demonstration	$13,600,000	*$3,000,000*
12. AFT, Inc. Advanced Coal Cleaning Demonstration	$9,200,000	*$2,000,000*
13. Combustion Engineering Integrated Demonstration	$269,000,000	*$32,000,000*

The fluidized bed combustion (FBC) system was recognized early in the State's program as an economically and environmentally sound method for converting industrial facilities to use Illinois coal. The technology involves burning coal with inert materials, such as limestone, in an upward current of air in the combustion chamber of a boiler. The air current causes the particles to behave like a liquid. The technology is efficient and proves simple, economical pollution control. More than 90 percent of the sulfur dioxide gases can be removed when limestone is added to the combustion chamber. The lower combustion temperatures required by the system also inhibit production of nitrous oxides.

Archer Daniels Midland Company, one of the worlds largest processors of corn and soybeans spent more than $100 million to make its Decatur plant self-sufficient for both process steam and electricity. This was accomplished by replacing five natural gas boilers with five, 425,000 pound-per-hour coal-fired Keeler/Dorr-Oliver Circulating Fluidized Bed Combustion boilers. The CFBC technology was chosen because of its economic advantages, low maintenance costs, and capacity to produce continuous duty steam in the volume required to power the five back pressure turbines and one extraction condensing turbine capable of cogenerating 108 megawatts of electricity, as well as meet the plants processing needs.

The innovative features of the K/D-O system include a single drum water-steam system which performs all the steam duty, thus eliminating the convection bank found in other systems. This minimizes the dimensions of each boiler, thereby reducing capital costs and space requirements. A unique "finwall" design for the combustion chamber adds heating surface which results in a reduction of the overall boiler height. A water cooled floor in the combustor minimizes the amount of refractory and limits maintenance costs. High combustion efficiency is maintained by means of the flue gas recycle and solids inventory regulation incorporated in the system design. In addition, waste heat from the ADM facility will be used to supply Richland Community College with a supply of hot water for heating and cooling on campus at no cost for 10 years. This feature alone is estimated to save the college $74,000 annually and ADM is expected to save up to $70 million in annual energy costs.

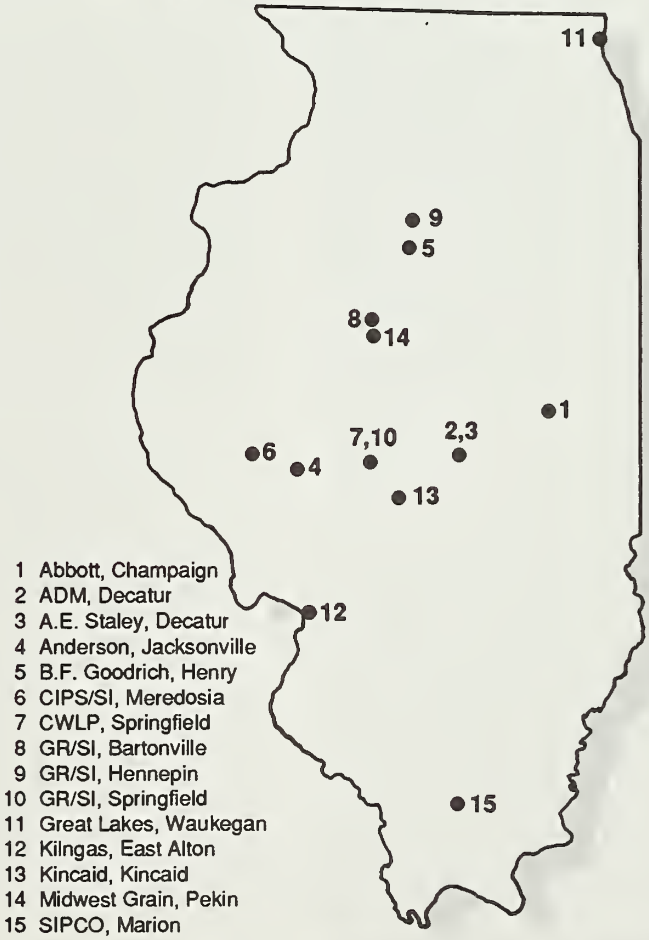
In addition to saving energy costs, the construction and operation of this boiler and cogeneration system is expected to generate significant economic benefits to the state of Illinois. Plant construction will create a maximum of 200 jobs during peak periods, and, once on-line, ADM will employ between 20 and 30 full-time employees for its operation. The plant will use approximately 1.25 million tons of coal and 416,000 tons of limestone per year, representing an estimated 500 permanent mining jobs and annual revenues of over $40 million.

To this project the state of Illinois contributed $6 million dollars from the Coal Development Fund.

14. RAM, Inc. Pircon-Peck Process Demonstration
$8,400,000
$4,200,000

15. Tecogen, Inc. Small Commercial Scale Fluidized Bed Combustion Demonstration
$2,600,000
$500,000

16. Southern Illinois University Fluidized Bed Combustion-Cogeneration Planning and Design Engineering
$30,070,000
$1,500,000



Illinois Office of Coal Development and Marketing Large Scale Demonstration Project Sites

COMMERCIAL DEVELOPMENT AND COAL MARKETING

In addition to its strong commitment to support Illinois' coal industry through funding for research and demonstration, the state's coal office also actively promotes increased coal use in current and prospective markets. Users of Illinois coal within the state can get assistance with assessment and financial aspects of coal projects through the Illinois Coordinated Review Process. The Illinois Coal Marketing Program extends use of Illinois coal and technologies to national and world markets.

The Illinois Coordinated Review Process

The coal office also manages the Illinois Coordinated Review Process, a voluntary governmental program that assists in the issuing of permits for major energy development projects that involve coal use. This process offers a comprehensive approach to project review, based on the office's coordinating of environmental and land use requirements, time frames and interagency relationships.

A project sponsor must request participation in the process. An interagency review board makes the decision on acceptance, based on the project's scope, impacts of and development stage. A coordinated review team that includes representatives of appropriate federal and local agencies works with the sponsor on the review process. The team develops an agreement that details the responsibilities of the agencies and the project sponsor, and provides guidelines for all regulatory and public participation activities.

The Illinois Coal Marketing Program

Illinois state government took an active role in coal development when the General Assembly created the Coal Marketing Program in January 1987 as part of the Illinois Office of Coal Development and Marketing (OCDM). The statute (ch. 96 1/2, par. 7402, sec. 11) requires the Illinois Department of Energy and Natural Resources to operate an office of coal marketing, in cooperation with the Illinois Department of Commerce and Community Affairs, for the promotion and marketing of Illinois coal both domestically and internationally. As research and demonstration projects have represented the largest expenditures for coal development at both the state and federal levels, the state of Illinois has placed increasing emphasis on protecting and expanding its coal markets.

With the advent of the coal marketing program, the OCDM has sought to publicize Illinois' business climate, its transportation infrastructure and its vast bituminous coal resources. In addition, the OCDM has sought specifically to promote coal not only as an abundant commodity but also as an energy resource that is compatible for widespread use with emerging clean coal technologies.

The overall objective of the Coal Marketing Program is to help Illinois industry penetrate new domestic and international markets for Illinois coal and coal-burning technology. Since sales of coal and the technology to burn it are critical to the success of the state's coal-marketing effort, ways to promote coal and clean coal-burning technology have received, and will continue to receive, major emphasis. Key to expanding and maintaining markets is promoting the clean coal technologies which offer environmentally sound burning techniques.

The OCDM has initiated informative marketing brochures highlighting major demonstrations of coal-fired technologies that have proved successful in testing or burning Illinois coal. In addition, the OCDM has drawn on the staffs of state offices operated by the Illinois Department of Commerce and Community Affairs in Brussels, Tokyo, Osaka, and Hong Kong to help the Illinois coal industry keep in touch with overseas coal research and development and international coal trade.

In its role as a facilitator of coal trade information, the Office of Coal Development and Marketing, in cooperation with the University of Illinois at Urbana-Champaign, has produced a computerized coal-marketing database that can provide such strategic information as the price and quality of all steam coal imported to a given country in a specific year, as well as the origin of that coal, the port to which it was exported, and the name of the purchaser. Through a prototype designed specifically for ENR, the database is designed to augment understanding of such items as: the characteristics of coal-fired boilers in a given area; the specifics of applicable environmental regulations for the place in question; a given locale's energy demand forecast; and the status, terms, and conditions of the long-term steam coal contracts currently in effect.

The database is managed by a prototype computerized expert system designed specifically for decision makers in coal marketing to experiment with a variety of variables in order to answer "what if" questions regarding future events that can affect the world coal market. The OCDM expects to expand the database and the expert system in the coming year to increase its store of information and to make this information more accessible to a wider audience of potential users.

This past year the Illinois Coal Development Board approved the necessity for initiating marketing efforts on a greater level than heretofore attempted through ENR's Office of Coal Development and Marketing. Through its Illinois Coal Export Development initiative, the office has proposed to assist the coal industry in Illinois in identifying and improving the full export potential of Illinois coal overseas. The office seeks to make ENR the recognized repository for scientific, technical, research, and engineering data on Illinois coal and compatible coal-burning technologies. This knowledge base of information will be made available on a subscription basis to qualified users. In order to manipulate this information effectively, a companion computerized expert system will be developed, implemented and provided to qualified users, also on a subscription basis. Fees from these subscriptions will eventually be used in a revolving account to help update and maintain the expert system and its concomitant knowledge base.

If ENR could return even greater knowledge from its prospective clients back to Illinois coal companies and likewise impart to these clients a keener sense of Illinois coal's usefulness, the state would stand a better chance of combatting Illinois coal's inferior image on the world energy market, while at the same time securing a more salable product abroad.

Through the Illinois Coal Export Development initiative, ENR has the means at hand to assist the ICDB in making available to interested groups that knowledge of Illinois coal research, development and demonstration that can conceivably increase the likelihood of Illinois coal use, particularly in the overseas energy markets.

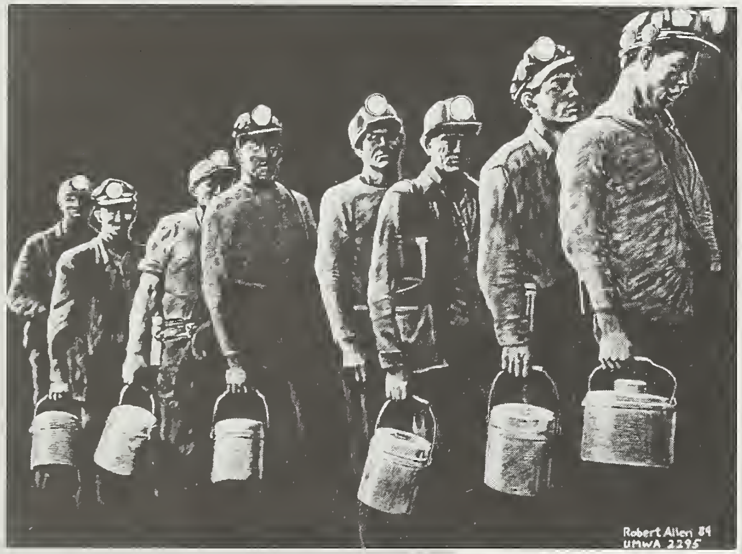
Since the spring of 1989, the Illinois World Trade Center, the Illinois Export Council, and the Illinois Department of Energy and Natural Resources have developed a cooperative venture with the Illinois World Trade Center for the promotion of Illinois coal exports through the EXILL Trading Company, a private, not-for-profit company in the Illinois World Trade Center. In addition to completing preliminary market research, EXILL has begun to build contacts with potential coal users in: Great Britain, the Netherlands, France, Italy, Spain, Portugal, Morocco, Mexico, and Taiwan. Thus, the elements are in place to progress toward the overall program objectives. The international coal/clean coal technology marketing initiative by EXILL Trading Company has four major program components: 1) identification of potential foreign markets, 2) development of a marketable package combining the sale of coal with appropriate incentives, 3) development of an international marketing strategy, and 4) establishment of an international communications system to facilitate coal trade.

The need to expand international sales of Illinois coal and clean-coal technology is heightened by the recent debate over acid-rain legislation. If tougher restrictions were placed on the use of higher-sulfur Illinois Basin coal, new and expanded overseas markets would require exploiting just to maintain existing llinois production levels. This program will help to identify and penetrate those niche markets that are, or will become, available for Illinois Basin coal.

ILLINOIS COAL IN ART

Coal is not only useful as a fuel, but also can be appreciated as an object of art. In 1988, an effort to make the public at large more aware of Illinois' most abundant fuel resource, ENR, in cooperation with the Illinois Art Council, sponsored a statewide art competition featuring Illinois coal. Known as "Mineworks to Artworks: Illinois Coal in Art," the competition focused on Illinois' mining heritage.

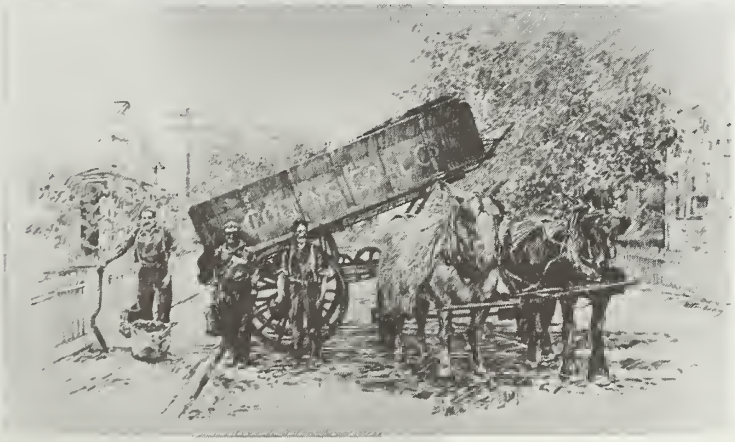
"Midnights"
Robert S. Allen



Amateur and professional artists from across the state were invited to submit works of art in several media, depicting scenes in the life of coal communities throughout the state. Entry categories for media included pencil, pen and ink, charcoal, printing, photography, and sculpture. This particular competition has given artists an opportunity to give expression to images indigenous to the state and its heritage and has served to promote artistic activities in the state as well.

The winning entries were selected by a panel of qualified arts professionals and displayed with the state of Illinois traveling coal exhibit during the run of the DuQuoin State Fair. Winners of this past competition were awarded U.S. Savings Bonds.

"Teamwork"
John Stribrny



Awards were presented for the following artwork:

"Midnights," a chalk pencil rendering of miners readying for the underground late shift, by Illinois coal miner Robert S. Allen of St. Louis, Missouri.

"Teamwork," a work in pencil depicting coal deliveries of yesteryear, by John Stribrny of Palos Park, Illinois.

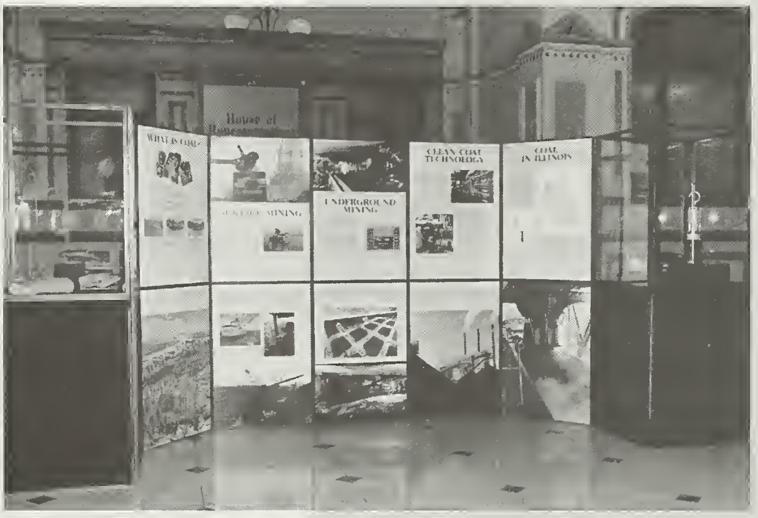
"Gray Day at New National Mine," an oil painting of a coal mine closing, by Edward L. Karasek of Belleville, Illinois.

"Loading Southern Illinois Coal," an acrylic painting of a steam locomotive and tender taking on a load of coal, by Barry Mosley of West Frankfort, Illinois.

"Despair," a charcoal rendering of John L. Lewis at a mine disaster in West Frankfort, by W. Bryan Ellis of West Frankfort, Illinois.

State of Illinois Traveling Coal Exhibit

An exhibit on Illinois' most abundant natural resource is available for display throughout the state.



The exhibit includes information on the history of coal; coal technologies that remove impurities, such as sulfur; mining techniques and samples of coal, plant fossils, and minerals. Color photographs depict mining equipment, including some of the largest surface mining machines in the world and computerized underground machines that move tons of coal to the surface.

The display also informs the public about the state's coal production. Illinois is the fifth largest coal-producing state in the nation, mining about 60 million tons of coal annually. An estimated 181 billion tons of coal lie within Illinois borders.

The state's vast coal reserves were created more than 300 million years ago, when a huge peat swamp covered what is now central and southern Illinois. Through the centuries, seas inundated the swamp and left deposits of other materials. The resulting chemical reaction left veins of rich coal with sulfur woven into it.

The Illinois Department of Energy and Natural Resources prepared the exhibit in cooperation with the Illinois Coal Association and the Illinois Department of Mines and Minerals. The exhibit is part of ENR's coal marketing plan, which includes working with potential overseas clients and developing an international advertising campaign to market Illinois coal.

The Illinois State Museum displays the exhibit when it is not on loan.

ILLINOIS COAL AWARENESS PROGRAM

The newly initiated 1989 Illinois Coal Awareness Program is intended not only to improve the public perception of coal, but also to increase coal use by educating decision makers about the clean coal burning technologies that have been successfully demonstrated.

The great resource coal represents for the United States in terms of energy security, domestic employment, and potential for export is drastically underutilized. The primary reason is a general lack of knowledge among the general public and policy makers alike on the nature of coal, the advances that have been made in mining and clean coal technologies, and the possibilities for responsibly increasing the use of this valuable resource without compromising environmental quality. Consequently, coal is judged--and frequently dismissed --on the basis of outmoded perceptions.

The tremendous effort and resources that have been dedicated to the development of clean coal technologies have yielded a wealth of positive, progressive, and compelling data. Recent poll results indicate that there is a great deal to be gained by educating people about the efforts that have been made. Even though people initially state a preference that coal not be used in the future and say they are willing to sacrifice economic growth for the sake of environmental quality, 53 percent of Americans support legislation to encourage the research and development of clean coal technologies.

Since the general public is accustomed to deciding issues of importance based on the public's awareness, perception, and acceptance of those issues, it is obvious that increasing public awareness of the positive aspects of coal use is critically important. The environmental community and its supporters have taken every opportunity to reinforce a negative image of coal in general. Illinois coal suffers particularly from its image as a dirty, outmoded fuel, incapable of rising to the demands of a modern society.

The Illinois Coal Development Board (ICDB) and the Illinois Department of Energy and Natural Resources (ENR) recognize that imminent Congressional legislation could severely curtail the use of Illinois coal. It is hoped that the comprehensive Coal Awareness Program will help mitigate the effects of the most damaging provisions of the legislation. The ICDB's action to provide funding for a program to educate the public about modern coal use is an indication of the commitment to which the state of Illinois has pledged itself in its continuing support of coal, thus sending a message not only to the utility and industrial sectors of the business community, but to all sectors of society, that coal and compatible clean burning technologies can realize full commercialization, satisfying many of the nation's energy requirements, without sacrificing the quality of our natural environment.

The Illinois Coal Development Board (ICDB) oversees expenditures of the Office of Coal Development and Marketing (OCDM) programs that support the development of coal, including research projects, proof of concept, development, demonstration, and commercial activities. Through the creation of a broadly based coal awareness program and its support of OCDM's coal marketing efforts, the ICDB and ENR are unifying those individual program components.

In total, the programs are designed to maximize the cooperation among electric utilities, industrial operators, research institutions, private laboratories, state governments, and the federal government. It is hoped that promotion and marketing of Illinois coal will help to protect our investment by increasing the knowledge and qualifications of the business community to actively participate in clean coal efforts and by enabling public officials and their constituents to view the use of coal in today's society from a more balanced perspective. The facts, taken together, present a compelling case for coal's importance and its right to full and fair consideration as a viable energy resource.

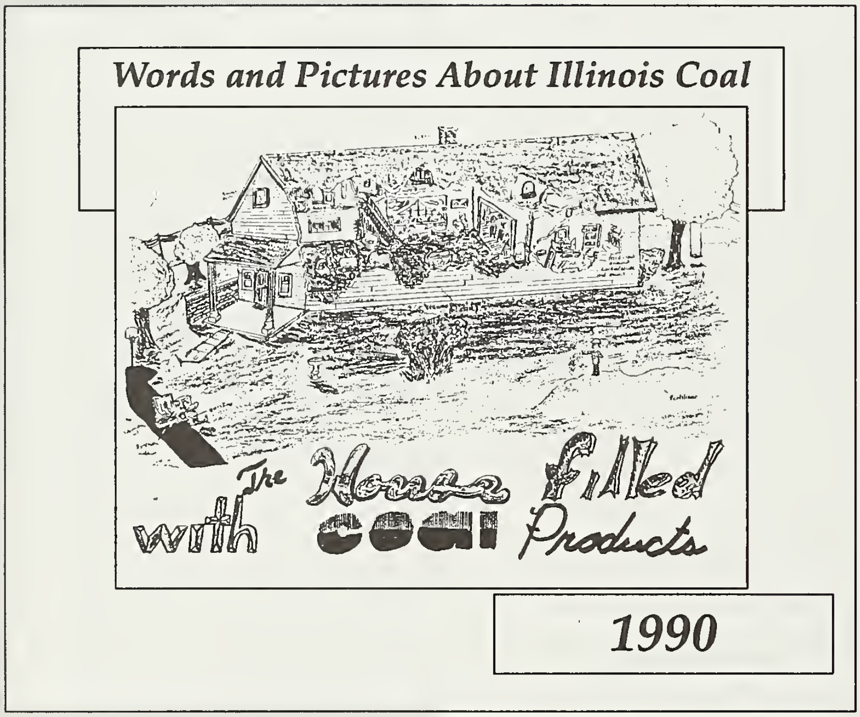
Words and Pictures About Illinois Coal

One aspect of the Illinois Coal Awareness Program is the “Words and Pictures about Illinois Coal” competition. More than 1,300 Illinois fifth and sixth graders increased their understanding of coal issues while they competed for prizes in the first annual statewide art and essay contest about coal.

Thirteen young artists and 12 budding authors were awarded $50 savings bonds for their winning entries. The successful entrants also received certificates from the state, congratulating them on their accomplishments. The winners' homeroom teachers were awarded laminated copies of the Illinois satellite image map with its accompanying teaching guide.

Students submitted entries in various categories, including Uses of Coal, What is Coal, the Importance of Coal in Illinois History, and How My Family Uses Coal. Entries reflected the effects of the coal industry on individual family histories as well as coal's effect on the growth of the entire state. The lesson best learned was well summarized by Matt Link of Carlinville whose winning essay concluded with the words: "Americans make use of coal often and they do not realize it. This great rock makes our lives easier."

A 1990 calendar showcasing both the art and essay winners' entries was produced. The contest was co-sponsored by the Coal Research Center at Southern Illinois University. It will be held annually each spring from now on.


Words and Pictures About Illinois Coal
The House filled with coal Products
1990

Awards were presented for the following artwork:

"The House Filled with Coal Products,"
by Dan Laib, Joliet, Illinois,
Washington Junior High School

"What Coal Means to My Region,"
by Courtney Wise, Elkhart, Illinois,
Elkhart Grade School

"What Coal is Used For,"
by Mark Reynolds, O'Fallon, Illinois,
Evans School

"Coal Mine,"
by Stephanie Greathouse, Minier, Illinois,
Minier/Armington Elementary School

"Products Made from Coal," by Michelle DeMoss and Cori Malcom,
Minier, Illinois, Minier/Armington Elementary School

"Coal Workers," by Justin Smith,
Armington, Illinois, Minier/Armington Elementary School

"Coal," by Angie Dawson,
Chicago, Illinois, John T. Pirie School

"Coal has Many Uses," by Erin Kepka,
Wheaton, Illinois,
Wheaton Warrenville Middle School

"What Coal is Used For," by Mat Wheat,
Collinsville, Illinois, Lincoln School

"What Coal is Used For and What It Is," by
Jennifer Powell, Minooka, Illinois,
Minooka Junior High School

"What Coal is Used For," by Brandon Millburg,
Chatham, Illinois, Glenwood Junior High School

Coal Mine

Stephanie Greathouse,
Minier, Illinois,
Minier/Armington Elementary School

"Mining Means Jobs," by Molly Donaldson,
Collinsville, Illinois, Lincoln School

"Coal is Important," by Joe Margason,
Woodstock, Illinois, Clarence Olson School

Awards were presented for the following essays:

"The Importance of Mining and Coal Use in Illinois History," by Beth Brayfield,
DuQuoin, Illinois, DuQuoin Community District #300

"What Coal Is," by Regina Blakely,
LaHarpe, Illinois, LaHarpe Elementary School

"The Importance of Mining and Coal Use in Ilinois History," by Nicole Bruhn,
Staunton, Illinois, Staunton Unit #6

"What Coal Means to Our State," by Jared Ruyle,
Carlinville, Illinois, Carlinville Junior High School

"The Uses of Coal," by Justin Smith,
South Pekin, Illinois, South Pekin School

"The Importance of Mining and Coal Use In Illinois History," by Mark Hitz,
Dallas City, Illinois, LaHarpe Elementary School

"What Coal is Used For," by Todd Barlow,
Carlinville, Illinois, Carlinville Junior High School

"How Coal is Used," by Scott Jacobson,
Minooka, Illinois, Minooka Junior High School

"How My Family Uses Coal," by Travis Heckenberg,
LaHarpe, Illinois, LaHarpe Elementary School

"What Coal is Used For," by Zeb Hill,
Staunton, Illinois, Staunton Unit #6

"What is Coal," by Gina Kim,
Flossmoor, Illinois, Parker Junior High School

"The Uses of Coal," by Matthew Link,
Carlinville, Illinois, Carlinville Junior High School

APPENDIX: COAL RESEARCH PROJECTS

List of research projects funded by the Illinois Coal Development Board from September 1, 1988 through August 31, 1989

Title of Project	Principal Investigator	Institution	Amount Funded
Coal Cleaning			
Advanced Physical Fine Coal Cleaning by ISGS Aggregate Flotation	J. Lytle	ISGS	$130,428
A Method for Dewatering, Agglomerating, and Pelletizing Cleaned Fine Coal	A. Kent	SIU-C	$67,888
Coal Flotation by Intrinsic Bubble Formation	E. Hippo	SIU-C	$41,498
Explosive Fracture Comminution Process for Coal Cleaning Using Supercritical Carbon Dioxide	R. Narayan	Purdue	$89,707
Chlorine Removal from Coal by Wet-Grinding and Leaching Processes	C-L. Chou	ISGS	$31,997
Improvements in Fundamentals of Foam and Column Separation of Fine Coals	J. Slattery	NU	$147,167
New Organic Desulfurization Chemistry	L. Stock	UC	$91,494

Research Institutions Funded

Acurex Corporation
(AC)

Argonne National Laboratory
(ANL)

Arthur Conn & Assoc.
(A.Conn)

Babcock & Wilcox
(B & W)

Batelle Memorial Institute
(BMI)

Center for Res. on Sulfur in Coal
(CRSC)

Eastern Illinois University
(EIU)

Electric Power Research Institute
(EPRI)

Gas Research Institute
(GRI)

Illinois Institute of Technology
(IIT)

Illinois State Geological Survey
(ISGS)

Illinois State University
(ISU)

Indiana Energy Development Board
(IEDB)

Institute of Gas Technology
(IGT)

Intech, Incorporated
(II)

M-C Power, Corp.
(M-C PC)

Northwestern University
(NU)

Pittsburgh Energy Technology Center
(PETC)

Purdue University
(Purdue)

Sargent & Lundy
(S & L)

Sonic Resources, Inc.
(SRI)

Southern Illinois University at Carbondale
(SIUC)

U.S. Environmental Protection Agency
(USEPA)

University of Chicago
(UC)

University of Illinois at Chicago
(UIC)

University of Illinois at Urbana-Champaign
(UIUC)

University of Kentucky
(UK)

Microbial Suppression of Pyrite from Illinois Coals: Engineering and Scale-Up	J. FitzPatrick	NU	$91,619
Supercritical Fluid Extraction for Chemical Cleaning of Illinois Coal	C. Eckert	UI-UC	$90,818

Combustion

Regime Delineation, Combustion, and Desulfurization in Fluid-Bed Coal Combustors	S. Saxena	UI-C	$56,916
Sorbent Evaluation for Pressurized Fluidized-Bed Combustors	M. Rostam-Abadi	ISGS	$43,716
Reactivity and Combustion Properties of Coal-Derived Solid Fuels	M. Rostam-Abadi	ISGS	$88,783
Combustibility of Chars from Illinois Coals	G. Clark	B & W	$29,054
Circulating FB Combustion and Rheology of Coal Water Slurry Fuels	S. Rajan	SIU-C	$75,000

Fuels and Chemicals

Mild Gasification Studies with Illinois Coals	S. Babu	IGT	$120,000
Production of Premium Liquids by Mild Gasification	C. Kruse	ISGS	$79,975
Chemicals from Coal and Methane	G. Smit	SIU-C	$97,634

Characterization

Characterization of Organic Sulfur Compounds in Coals and Pure Macerals	J. Crelling	SIU-C	$132,682
EPR Microscopy of High Sulfur Illinois Coals	R. Clarkson	UI-UC	$83,855
Spatial Distribution of Organic Sulfur in Selected Illinois Basin Coals	R. Harvey	ISGS	$22,991

Related Desulfurization Studies

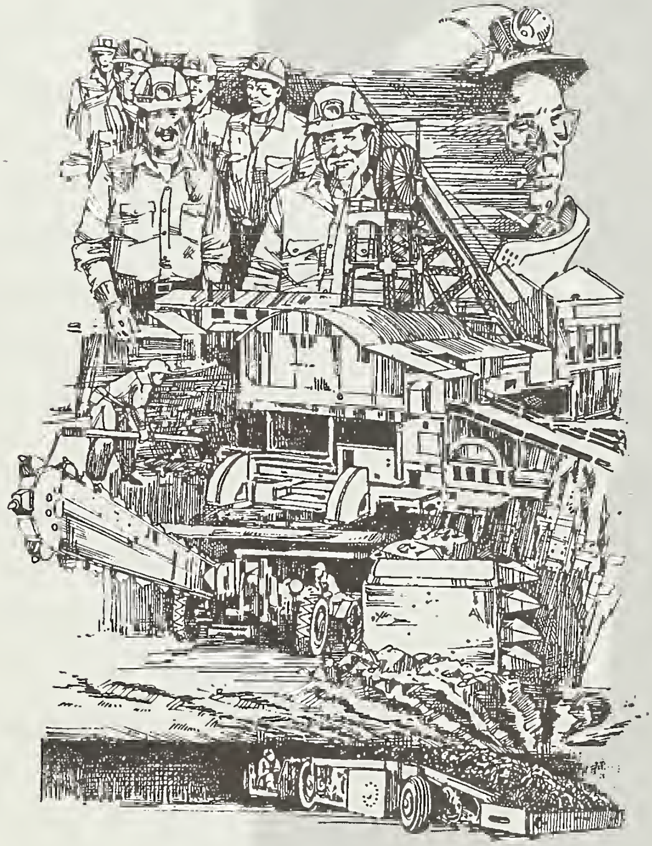
Economic Evaluation of Dry Physical Coal Cleaning	L. Carter	L. Carter, P.E.	$24,662
Economic Evaluation of a Coal Dechlorination Process	W. DePriest	S & L	$68,000
Economic Evaluation of a Process for Preparing High Surface Area Hydrated Lime	A. Conn	A. Conn	$37,200
Chlorine-Induced Corrosion in Coal Preparation Plants	J. Swisher	SIU-C	$42,663
Factors Affecting Management of Fine-Coal Cleaning Waste Solids	G. Dreher	ISGS	$93,225

Gas Cleanup

Development and Evaluation of High Surface Area Hydrated Lime for SO_2 Control	M. Rostam-Abadi	ISGS	$97,578

Combustion of Char in PFBC and Measurements of its Alkali-Vapor Emission	S. Lee	ANL	$99,500
Other Activities			
Implications of an "Ordered" Heteroatom Distribution in Coal	C. Kruse	ISGS	$16,691
Preparation and Delivery of Coal, Char, and Hydrated Lime Samples	W. Chem	ISGS	$4,872
Information System on Illinois Coal V: Data Base Promotion	C. Trask	ISGS	$9,902
Illinois Mine Subsidence Research Administration	P. DuMontelle	ISGS	$37,288
Investigation of the Effects of Subsidence from Underground Coal Mining in Illinois on Hydraulic Properties and Groundwater Flow	C. Booth	NU	$41,142
Surface Subsidence Monitoring at a Shallow Partial Extraction Room and Pillar Mine in Central IL	P. Chugh	SIU-C	$15,988
Identification of Mine Characteristics, Conditions & Procedures for Design of Stable Partial Extraction Room & Pillar Mining Areas in IL	P. Chugh	SIU-C	$59,883
Effects of Coal Mine Induced Subsidence on Agricultural Soils	R. Darmody	UI-UC	$65,462

Coal Mine Subsidence Mitigation: Effectiveness for Agricultural Restoration	R. Darmody	UI-UC	$62,866
Monitoring and Research Assoc. with Instrumented Sites of the IMSRP	P. DuMontelle	ISGS	$41,219
In Situ Testing of Coal Blocks in Illinois Underground Mines	J. Mahar	UI-UC	$63,520
Public Information and Technology Transfer: IMSRP	B. Trent	ISGS	$17,410



List of cost-shared research projects funded by the Illinois Coal Development Board from September 1, 1988 through August 31, 1989

Title of Project	Principal Investigator	Institution	Amount Funded
Cleaning			
Comminution Employing Freezing Temperature Pretreatments/PETC	S. Yen	SIU-C	$28,432
Particle Size Enlargement of Fine Coal or Char Using Lignocellulosic Residue/TVA	H. Ehrlinger	ISGS	$30,550
High Sulfur Coal Research: Cleaning/EPRI Consortium	Various	EPRI	
Coal Desulfurization Using Perchloroethylene	D. Buchanan	EIU	$98,000
Combustion			
Furnace Sorbent Reactivity Testing for Control of SO_2 Emissions from Illinois Coals/EPA	K. Bruce	AE	$70,000
CFBC Testing of Illinois Mine Run Coal, Washed Coal, and Coal Cleaning Wastes/EPRI	M.P. Hooper	B & W	$91,173
Metal Wastage Consortium/ DOE/METC, EPRI, TVA, B&W, C-E, F-W	Various	UI-UC	

Particle Motion Relevant to Tube Erosions in Fluidized Beds	M. Chen	UI-UC	$74,989
Coal Catalyzation to Simplify the Conversion of Coal to SNG/GRI	H. Feldman	BMI	$25,000
Characterization of Colomites for Desulfurization During Gasification/GRI	A. Rehmat	IGT	$70,000

Characterization

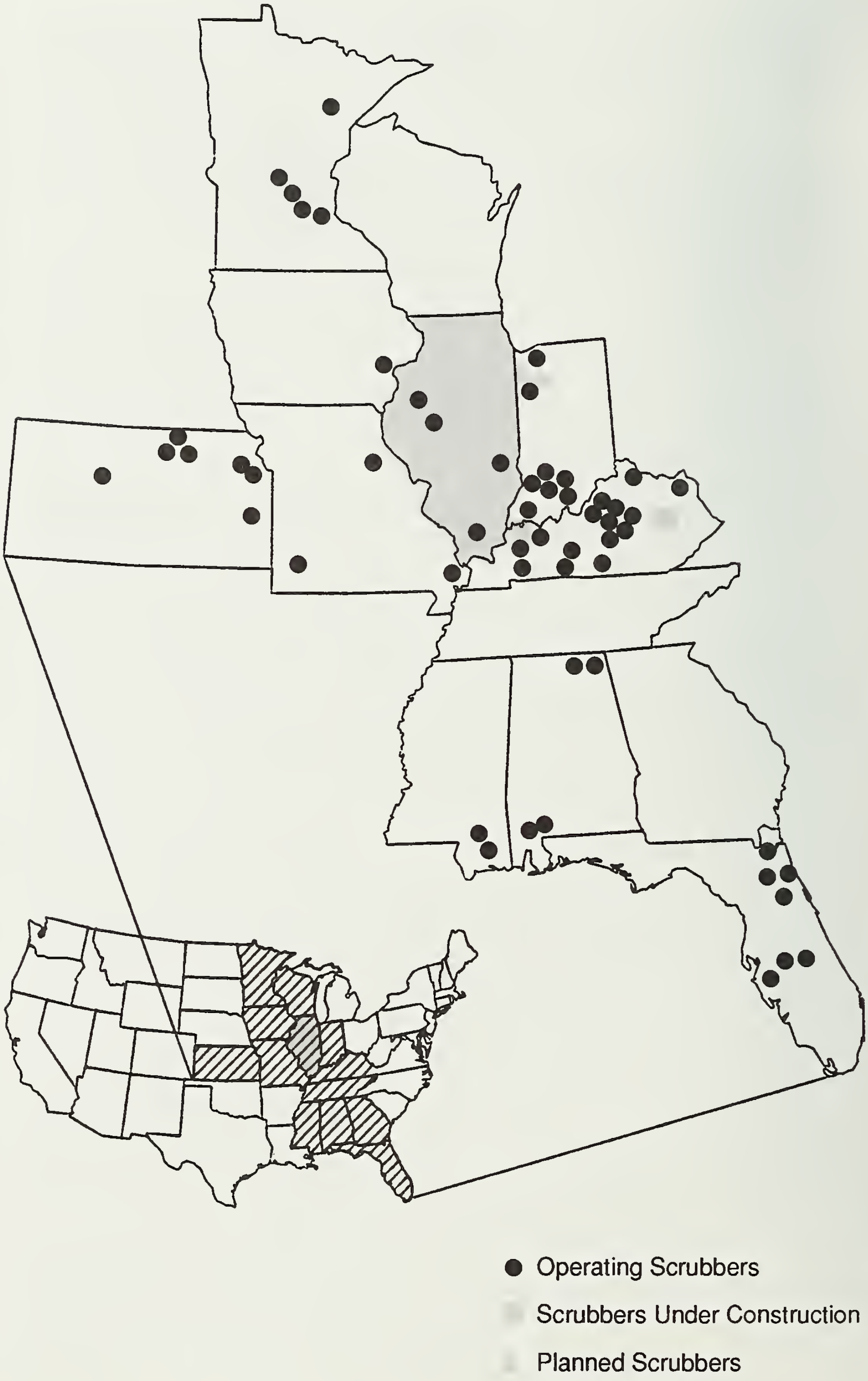
High Sulfur Coal Research: Characterization/EPRI Consortium	Various	EPRI	$22,000

Other Activities

Conference on Chlorine in Coal/EPRI	J. Stringer	EPRI	$12,000
Illinois Basin Coal Sample Program/Indiana Energy Development Board	C. Kruse	ISGS	$46,040

LOCATION OF POWER PLANT SCRUBBERS IN THE ILLINOIS COAL MARKET

March 1990



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